

THE ECONOMIC GEOGRAPHY OF A  
MICRONESIAN ATOLL

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## THE ECONOMIC GEOGRAPHY OF A MICRONESIAN ATOLL\*

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AS an incidental result of World War II the United States acquired a new island-strewn domain in the mid-Pacific. Sometimes popularly referred to as American Micronesia, the area coming under American control is now officially known as the United States Trust Territory of the Pacific Islands. Though the general facts are known regarding the trade of the islands there have been heretofore no detailed studies of their economic geography. The purpose of this paper is to present such a detailed study of one element of American Micronesia—Mokil, an island group in the eastern Carolines. The land area represented by all of the islands of the Trust Territory together is small and Mokil forms only a tiny fraction of this land area. But it is only through the detailed study of such unit areas here and there throughout American Micronesia that a reliable over-all picture can be obtained of America's new island charges in the Pacific.

In addition to its significance as a unit of the newly acquired island empire, Mokil is representative of a class of island clusters that is widely distributed throughout the tropical Pacific, the atoll. Since people behave differently even in similar natural environments, no atoll can be considered typical of all atolls in its economic geography. But atolls as a class *are* remarkably uniform in their physical characteristics and especially in the limitations they impose upon human occupancy, and one cannot fail to be impressed by observable similarities even in the human phases of geography as one atoll after another is visited. The present study in addition to the information it contains regarding Mokil, an element of American Micronesia, is presented as a contribution to the economic geography of Pacific atolls as a class.

### LOCATION AND PHYSICAL CHARACTERISTICS

Mokil is small even among atolls, a tiny cluster of islands in the vast Pacific Ocean. Its half a square mile of land may be compared with an average land area of about one square mile for the 80 or 90 atolls of American Micronesia. It is only when the easternmost Caroline Islands are represented on a map of large scale that Mokil is likely to appear (Fig. 1). Then it will be found to lie at 6° 40' N. latitude and 159° 47' E. longitude. It is 60 statute miles from its nearest neighbor,

\* This study is one of several based on the author's seven weeks of field work in Mokil in July, August, and September, 1947. The project was one of a series of investigations throughout American Micronesia begun in the summer of that year. The general program was known as the Coordinated Investigation of Micronesian Anthropology (CIMA) and was sponsored by the Pacific Science Board of the National Research Council. Human geography was one of the fields represented.

Pingelap, another atoll, and 100 from Ponape, the nearest volcanic island.<sup>1</sup> Mokil is 3100 statute miles west-southwest from Honolulu by the most direct path, but about 5000 from Honolulu following the official pathway via Guam, Truk, and Ponape.

Like most other atolls of the South Pacific, Mokil consists of islands (*motus*), a lagoon, and a reef (Fig. 2). The largest island, Kalap, is a little over a mile in north-south length. Urak, though not so long, is almost equal to Kalap in area; Manton is about one-half as large as Urak. The lagoon, so characteristic a feature of most atolls, lies between Kalap and Manton. Elsewhere, surrounding the islands and fringing them on their seaward edges, is a shelf-like coral reef, and

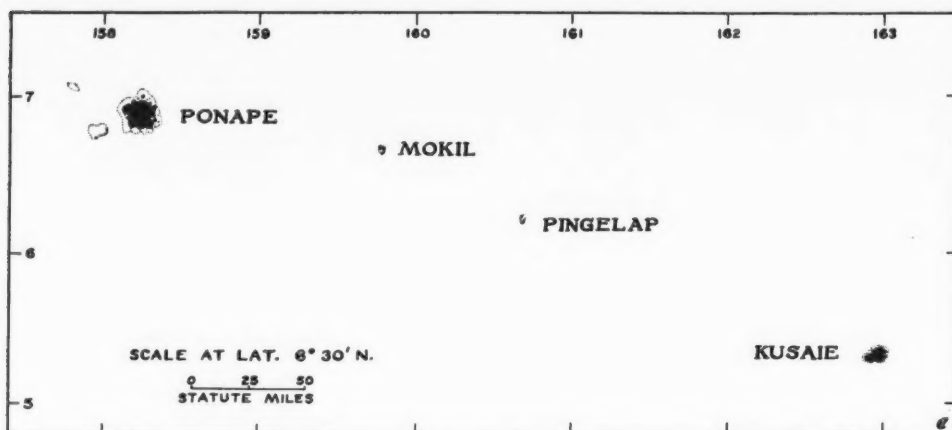


FIG. 1. Mokil in relation to neighboring island groups of the easternmost Carolines.

reefs underlie the water that separates Kalap and Manton from Urak. There is no ship channel through the reef, and the visitor to Mokil must end his journey by whaleboat or canoe.

In its landform characteristics Mokil is much like other atolls. The three islands are low and flat with the highest point less than 20 feet in elevation. Each island consists of a foundation of coral limestone covered with loose coral rock broken into sand and rubble and piled up by wind and waves at some time in the past.

There is little real soil in Mokil. The surface material is stony and drainage is excessive. With depth the stony veneer gives place to a finer textured material with enough organic matter to have a dark gray to black color, but the sum total is still far from good soil. The lack of a substantial soil sets one of the most severe limits to agriculture in Mokil as it does in atolls in general.

The climate of Mokil reflects the low altitude. Though there are no climatic

<sup>1</sup> Both in physical and in human geography the two atolls, Mokil and Pingelap, are in marked contrast to the neighboring volcanic islands, Ponape and Kusaie. See Raymond E. Murphy, "High and Low Islands in the Eastern Carolines," *Geographical Review*, XXXIX (1949): 425-439.

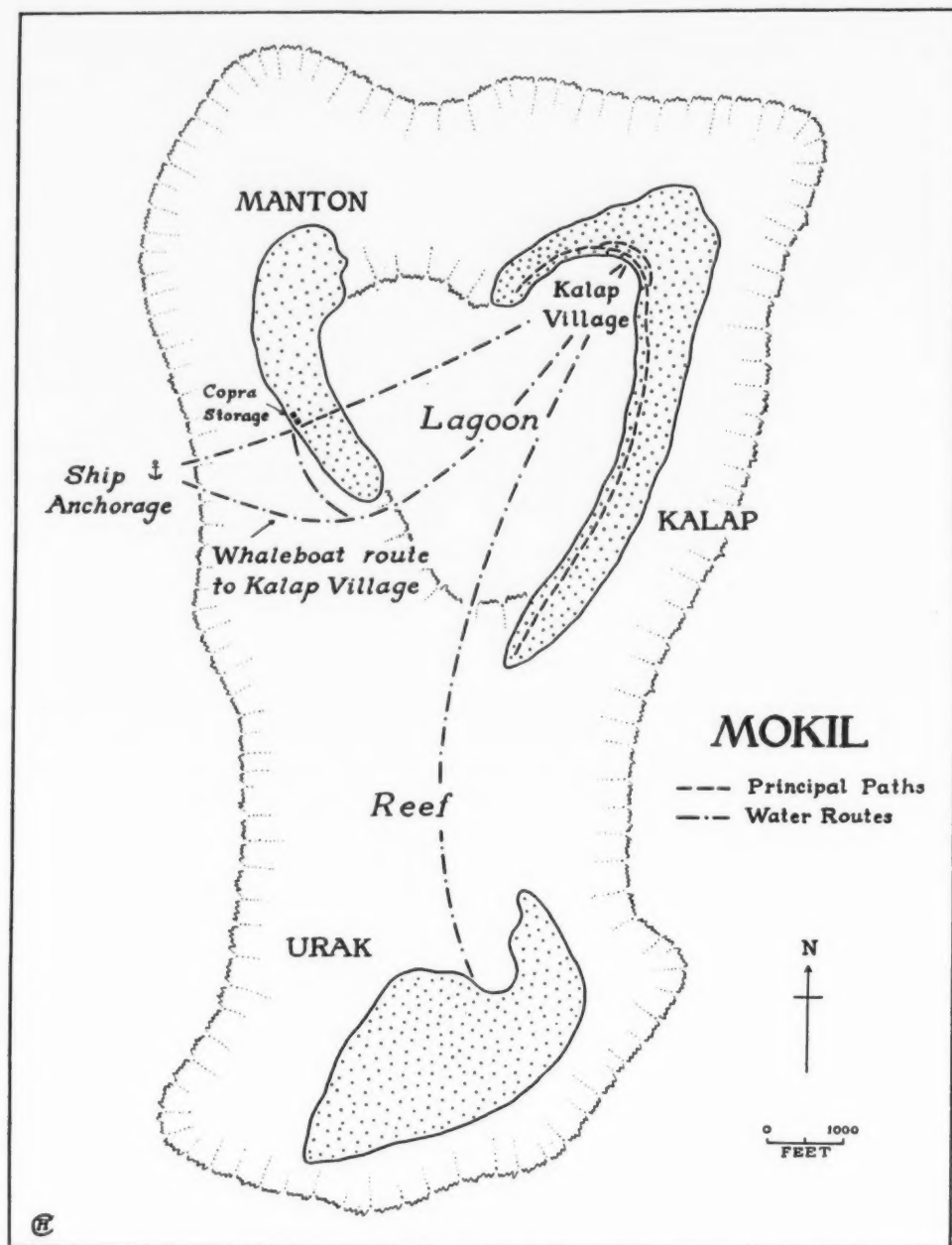


FIG. 2. Mokil consists of motus, a lagoon, and a reef.

records for Mokil itself, data are available for the neighboring volcanic island, Ponape, and certain differences between the two are a matter of common knowledge

in the region. Thus it is possible to arrive at an approximate picture of Mokil's climate. Temperatures are high throughout the year, probably averaging between 80 and 85 degrees Fahrenheit for every month. Similarly, it is estimated that the atoll's rainfall approximates 100 inches annually. Trades prevail most of the year. They are reported to be strongest in January and February, which is the period of least rain, and at that season they blow constantly from the northeast. In the July-August period, on the other hand, though trade winds still predominate they blow more often from an easterly or southeasterly quarter. Typhoons are rare, since Mokil lies well to the east of the main typhoon tracks. The last recorded one occurred in 1905.

In spite of the high rainfall total, extreme porosity of soils makes the problem of water supply serious. During the wetter portions of the year chief dependence is placed upon rainfall, which is collected in drums either from houses with galvanized iron roofs or at the bases of inclined coconut trees, their trunks scored to channel the water. Concrete cisterns with galvanized iron roofs were fairly common in the Japanese period; most of these are now cracked or otherwise useless because of poor repair. Open wells have been dug and are the chief reliance of the people in dry periods, but the water in the wells tends to be brackish and unpalatable.<sup>2</sup>

In view of the poor quality of atoll soils, the vegetation of Mokil shows surprising variety. The natives were able to give the writer the names, characteristics, and principal uses of 25 distinct trees. A few of these trees have been introduced by man, but certainly many, if not most, must be assumed to have arrived by the various natural means through which plant life spread over the Pacific. The coconut is by far the most common tree and pandanus ranks second in abundance. In addition to trees, several grasses and a number of other plants grow wild. Most of them are native to Mokil, and several play important roles in the atoll's economy.

The *motus* are poorly supplied with resources other than vegetation. Birds and coconut crabs add only slightly to the food supply, and Mokil has no mineral deposits of economic value.

The ocean, on the other hand, has resources of great value to the atoll people. First, of course, are fish. Especially are the reef and the ocean just outside the reef significant in this regard. And sea water itself is important, as most families even today evaporate it to fill part of their salt needs.

#### MOKIL'S PAST

Mokil has been known to the Western World for a century and a quarter and yet in its fundamental aspects life in the atoll appears to be much as it was before

<sup>2</sup> The problem of a supply of drinking water has to be faced by the field worker. The writer solved it by catching a bucket of rain water directly from a galvanized iron roof during heavy showers and then keeping this pail of water covered. The water soon became too warm to be pleasant tasting and sometimes after a few dry days there was little left, but at least it was not contaminated. In the field, "drinking coconuts" furnished the needed liquid.

"discovery" by Duperrey in 1824.<sup>3</sup> Apparently, people had been living in Mokil for a long time even then and *Cyrtosperma* (the great root crop of the atolls), coconuts, and breadfruit were basic crops even as they are today.

Yet it would be a mistake to assume that Mokil remained entirely unchanged by outside contacts. Trade soon resulted in new markets and new desires, and successive groups of outsiders left their impress on the atoll life. The missionaries, the Spaniards, the Germans, and the Japanese in turn modified the native culture. World War II and the coming of the Americans have brought still further changes. The 450 people who occupy Mokil today show in their features and in their culture the effects of these contacts with the outside world.

#### AGRICULTURE

The economy of Mokil today is characterized chiefly by agriculture with fishing in an important, but secondary, role. Boatbuilding, an activity in which the atoll has gained considerable fame, is of significance chiefly as an adjunct to agriculture and fishing, and native handicrafts are a minor additional economic interest.

Mokil's agriculture is based on two very different classes of land (Fig. 3). By far the greater proportion may be classed as "coconut land"—normal atoll land with the low relief and the veneer of coral fragments typical of atolls. In contrast to the coconut land are the "wet gardens", which total less than 5 per cent of the atoll's area, but play a much more important role in agriculture than their size would suggest. These are man-made depressions in which organic material has been placed and has accumulated until a substantial black soil has resulted. In Figure 3 the wet gardens stand out in black; all the remainder of the land is coconut land even though locally breadfruit, bananas, or some other crop may be important.

#### *The Wet Gardens*

The wet gardens have certain uniform characteristics. All have been excavated by man.<sup>4</sup> All of the depressions are so low as compared with the average ground surface of the atoll that water stands in them for some time after rains. All, too, avoid the coast and the narrower sections of the islands because of danger of contamination by sea water. All have black soils for which man has been responsible. And, lastly, the wet gardens are cultivated in the fullest sense of the word (Fig. 4).

Actually, there are two kinds of wet gardens (Fig. 3). Most of the largest depression on Kalap and the smaller one just west of its southern extremity have been in existence a long time (Fig. 5). In these two ancient wet gardens land ownership is highly divided and is expressed in rows rather than in terms of area.<sup>5</sup> In con-

<sup>3</sup> For a summary of the coming of white men to the atoll see Anneliese Eilers' "Inseln um Ponape" (*Ergebnisse der Südsee-Expedition 1908-1910*, edited by G. Thilenius, II. *Ethnographie, B. Mikronesien*, Vol. VIII. Hamburg, 1934, pp. 359-404).

<sup>4</sup> The large depression in northern Kalap may be in part of natural origin, but if so the natural depression was further deepened by man long ago and has been extended from time to time along the edges.

<sup>5</sup> For details regarding land ownership in the wet gardens of Mokil see Raymond E. Murphy, "Landownership on a Micronesian Atoll," *Geographical Review*, XXXVIII (1948), 603 and 606.

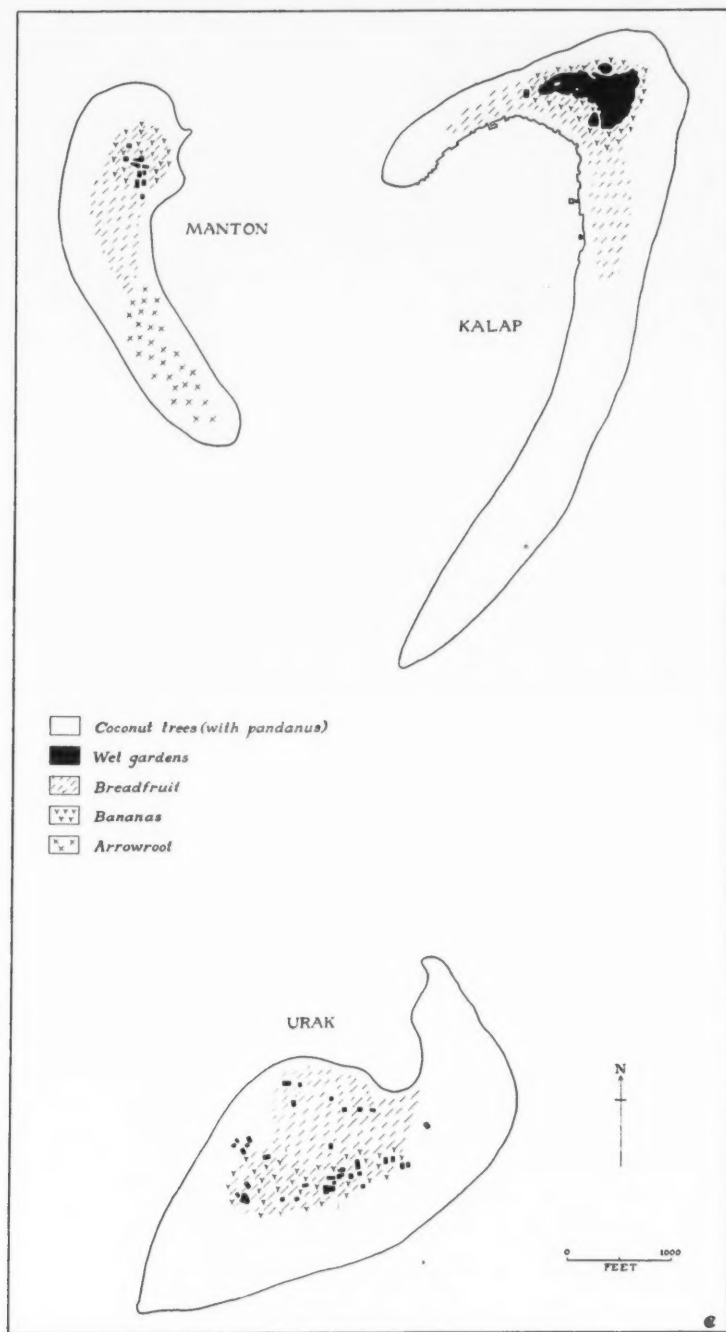


FIG. 3. Agricultural land use in Mokil.

trast to these ancient depressions are others that have been dug in modern times: extensions of the ancient wet gardens of Kalap, and a number of small pits scattered over the three islands.<sup>6</sup> Some of these modern extensions and separate pits are several decades old; a number date from World War II when Mokil was cut off from outside supplies for two or three years. A few have been dug since the War. The extensions and pits excavated in modern times differ from the ancient garden areas in the way in which the land is owned. Each of the modern excavations, whether it is a separate pit or an extension of the ancient taro areas, is likely to belong in its entirety to the family owning the surrounding coconut land.

*Cyrtosperma Chamissonis*, often mistakenly called "taro," is by far the most important crop of Mokil's wet gardens just as it is of comparable depressions in most other Pacific atolls. *Mwäng*,<sup>7</sup> which is the native name for the species, occupies perhaps 85 or 90 per cent of the land in the ancient wet gardens and nearly 100 per cent of the area in the modern pits and extensions. The reason for this contrast is that the soil in the ancient depressions has been accumulating over a longer period and is considered better for two other crops of the wet gardens, *Colocasia esculenta* (taro) and sugar cane, than is the soil of the modern excavations.

*Mwäng* is a large plant grown for its fleshy, barrel-shaped rootstock which may weigh as much as 50 pounds (Figs. 6 and 7). Since the mature plant stands 9 to 12 feet high and has leaves several feet in length, a wet garden with row after row of full-grown *mwäng* is an impressive sight.

Planting may be done at any time in the year. The section planted consists of the lower portion of the stalk cluster and the upper end of the rhizome. The *mwäng* plants are set in rows that are three to four feet apart, and within the row individual plants are placed about two feet apart.

Cultivation of *mwäng* consists of piling leaves and grass around the bases of the plants and, upon this, piling dirt dug from between the rows. The leaves of the *mes* tree (*Ceodes umbellifera*) are preferred just as are certain kinds of grasses, and bundles of leaves and grass are brought from the other islands to use in the big depression on Kalap. In cultivating *mwäng*, digging sticks or other implements may be used, but there is no good substitute for the hands since the aim is to work around the plants without disturbing the roots.

Generally a definite time schedule is followed in cultivating *mwäng*. The first application of leaves, grass, and mud is made three weeks to a month after planting; the second, six weeks later; the third, two or three months after this. Thereafter, the crop ordinarily receives no further attention except for weeding and the replacement of dirt in the rows when it is washed away.

*Mwäng* requires two or three years to mature. After that it may be left in the ground 10, 15, or even 20 years. It probably grows little if any after 15 years, but leaving it in the ground is a good way of storing the food until it is needed. Because

<sup>6</sup> The natives refer to these modern depressions as *bong*, in contrast to the two ancient depressions to which they apply the name *bwel*.

<sup>7</sup> *Mwäng* apparently corresponds to the *puraka* of the Polynesian atolls. See, for example, Peter H. Buck, *Vikings of the Sunrise*, New York (1938), p. 120.

of the large food yield of *mwäng* and its availability at all times the natives say it is the "boss" crop of the atoll. *Mwäng* is to the people of Mokil what rice is to many orientals.

*Mwäng* is prepared for eating in a number of different ways. It may be boiled or baked, or may be ground with pandanus, arrowroot, coconut meat, or molasses before cooking. In most meals in Mokil *mwäng* appears in some form and often in more than one form.

The second crop in importance in the wet gardens of Mokil is *Colocasia esculenta* or taro (Fig. 4). *Jaua*, the name by which the species is known to the natives, is like *mwäng* in that it is grown for its rootstock. Within the wet gardens it is confined almost entirely to the two ancient depressions of Kalap and even there occupies less than one-tenth as much land as *mwäng*.



FIG. 4. *Mwäng* and sugar cane rise above *jaua* plants in the ancient wet garden of northern Kalap.

*Jaua* differs from *mwäng* in a number of respects (Fig. 7). It is a much smaller plant with a rootstock weighing at a maximum only five pounds. Moreover, *jaua* matures in six months. Since the plants are smaller they are set closer together than *mwäng* plants, and since the growth period is shorter the intervals between successive periods of piling leaves and dirt around the plants are shorter. Finally, *jaua* is considered tastier than *mwäng*. It is a luxury crop in contrast to the staple food crop.

A few stalks of sugar cane are interspersed with *mwäng* and *jaua* in the large ancient wet garden of Kalap. The cane is chewed for its juice, but is not otherwise used.

#### Coconut Land

Of the land above high tide in Mokil about 95 per cent falls in the category of coconut land, or *sab* to use the native term (Fig. 8). Coconut land is, in short, all



FIG. 5. The ancient wet garden area of Kalap, with Kalap Village in the foreground. Note the paths that cross the depression and the way in which the rows of *mûāng* and *jua* extend from these paths at right angles. Along the edges of the ancient depression are recent additions, indistinguishable from the ancient area in the photograph. Typical coconut land surrounds the depression. Compare this picture with Figure 16. (Official U. S. Navy photograph.)

of the land of the atoll outside of the wet gardens. All of it is potentially coconut producing even though locally bananas or breadfruit may predominate and pandanus is everywhere abundant.

The coconut is by far the most important tree in Mokil. Even before the white man arrived the tree must have been a highly significant element of the atoll picture. It still finds many uses in the lives of the people, but the paramount use today



FIG. 6. A native of Mokil standing among his mature *mwäng* plants in the large wet garden of Kalap *motu*.

is for copra making. Through the sale of copra and little else the atoll dweller obtains the foods, clothing, and other merchandise from the outside world that he has come to consider so necessary. The fact that the natives themselves refer to everything except the wet gardens as coconut land shows the esteem in which the coconut is held.

Copra production is not evenly distributed in the three *motus*. Kalap produces more coconuts than either of the other two islands. However, all of the atoll's

people live on Kalap, and so great are the demands on that island's coconuts—for drinking, for human food, as feed for hogs and poultry—that Urak is a more important source of coconuts for copra. Manton, smaller than either of the other islands, is considerably less significant as a coconut producer and hence as a copra source.

The first step in actual copra production is harvesting the ripe nuts. In Mokil they are not taken directly from the trees, but are picked up, instead, from where they have fallen. Men, women, and children all help pick up coconuts from the several separate pieces of land held by the family.<sup>8</sup> This is commonly done once a month or at some intermediate time if there has been an unusually strong wind.

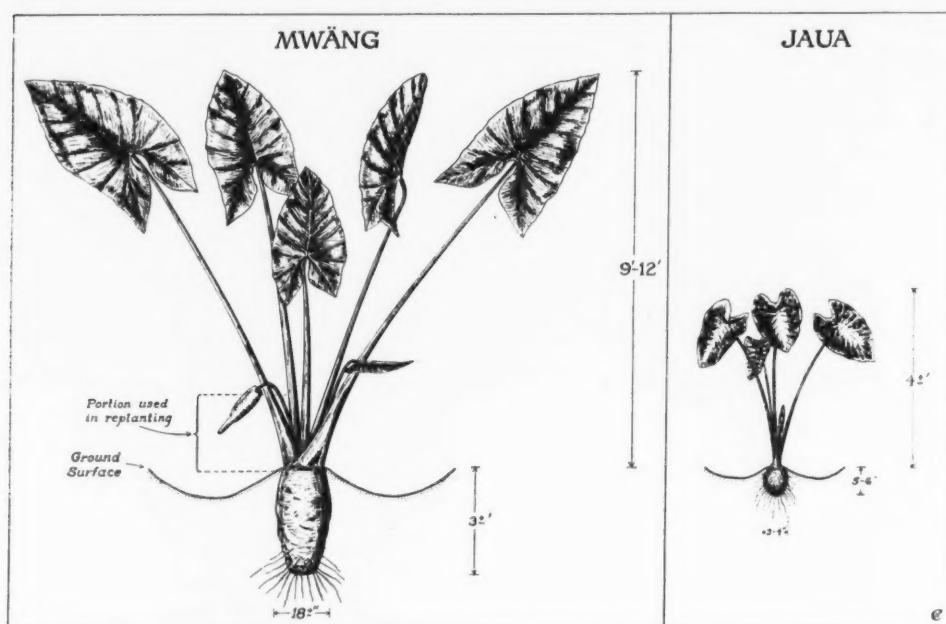


FIG. 7. *Mwäng* and *jaua* contrasted. (Drawn by Harold Champeau from the author's field sketches and photographs.)

The picking is rarely clean; some nuts are left, more or less accidentally, to sprout, whereupon they may be gathered for food (called *pär*) or left to form new trees, either where they have sprouted or at some site to which they are moved. The nuts for copra making are taken to some conveniently located point on the family's holdings, most often where a piece of land reaches the coast. Here they are husked to reduce the bulk.

The next step is the making of copra from the nuts. This is done at the homes of the people on Kalap, to which the nuts are taken from the other islands by canoe or whaleboat. Men and women work together at home, breaking the nuts and cutting

<sup>8</sup> For the manner of holding coconut land in Mokil see Murphy, "Landownership on a Micronesian Atoll," 606-607.



FIG. 8. Coconut trees in varying thicknesses of stands grow everywhere in Mokil except in the "wet gardens." In this picture taken in Kalap the men are making a canoe. To the left is the wide coral path edged with stones that runs from one end to the other of Kalap *motu*.

out the meat which is spread out to dry (Fig. 9). Four days of good sun are considered sufficient to dry the fresh coconut meat into copra. The copra is then ready for transfer to two storage sheds on the east coast of Manton, there to await arrival of the next station ship (Fig. 2). When a ship visits Mokil is generally anchors outside the reef west of Manton, and thus the copra is at the nearest possible point to the anchorage.

A few general facts regarding the copra business in Mokil may be added. Copra



FIG. 9. Coconut meat spread out to dry into copra in Kalap Village.

production goes on all year long, but reaches its peak in January and February at which time the wind is strongest and the weather driest. A good coconut tree on Mokil produces 40, 50, or even more coconuts per year. About 300 nuts are required to make one bag of copra weighing 100 pounds. It takes 20 bags of copra to make a ton, for which the natives received 80 dollars in the summer of 1947. Mokil's production is 70 or 80 tons per year, or about 300 to 400 pounds per acre of coconut land. The gross annual return to the people of Mokil for their copra is approximately \$6000.



FIG. 10. Trunk of a pandanus tree showing "walking sticks" that branch off near the ground.

Most families would like to produce more copra, since it is the chief means of obtaining the merchandise to which they have become accustomed. An added urge results from the increasing population density which is steadily reducing the per capita copra production. But all available coconut land is already in use.

Though coconut trees are the common denominator of Mokil's coconut land, locally they are relegated to second place by pandanus, breadfruit, or bananas.



FIG. 11. Typical pandanus fruit.

Pandanus, like the coconut, is primarily an atoll tree, and there are 15 or more varieties in Mokil. Some varieties are planted or at least encouraged; others are part of the natural forest. In one variety or another the tree is fairly evenly distributed throughout the coconut land of the three islands though nowhere does it constitute any very large proportion of the forest. The visitor to an atoll soon comes to recognize the clusters of long, drooping, sword-shaped leaves that characterize pandanus, the "walking sticks" that support the lower trunk, and the fruit that in size and general appearance resembles a pineapple (Figs. 10 and 11).

The uses of pandanus, or at least of the better varieties, are numerous. In the first place, the leaves furnish Mokil's prime thatching material (Fig. 12). The fruit



FIG. 12. Thatching a house with pandanus in Kalap Village.

of some varieties of pandanus is important as a food. The leaves are used in making mats, hats, and various other handicraft, and trunks of pandanus trees serve as crosspieces in all boat houses since they have the virtue of not sagging.

The breadfruit tree is another significant element in the atoll picture (Fig. 13). Though breadfruit is widely grown throughout the islands there are three areas of concentration (Fig. 3). Localizing factors are better-than-average soil and a forest dense enough to provide shade for the young trees. Urak ranks first among the three islands in number of breadfruit trees with Kalap a close second.

The fruit is harvested while still pea green in color. A long picking pole is used since the mature tree is 50 or 60 feet in height. The ripe breadfruit may be baked, fried in strips, boiled, or used in various combination dishes.



FIG. 13. A small breadfruit tree at the edge of the large ancient wet garden on Kalap. Around it bananas are growing in the partial shade.

The importance of breadfruit as a food is limited by its short season. Only June and July are considered to be prime breadfruit months. To prolong the period during which breadfruit can be used, some of it is mixed with coconut milk and stored in pits lined with leaves. The pits are covered with coral rock to prevent damage by rats and are protected against rain by special sheds with a roof, but without sides (Fig. 14). Pit breadfruit (*mär*) remains edible for years.

The breadfruit tree is considered to be the most important lumber source in the atoll. Its wood is used in making canoes, whaleboats, and paddles; and the logs are sawed by hand into lumber for house construction. Much more breadfruit lumber would be used if more trees were available for cutting, but unfortunately the supply is becoming increasingly scarce.

Breadfruit appears to have declined in importance in Mokil. It is not a commercial crop and thus has lost out to the coconut. As a food, breadfruit suffers rela-

tively since it is not as reliable as *mwäng*. It is available for only a few months of the year, and the yield varies considerably from year to year. With the atoll's ever-increasing pressure of population, breadfruit's relative decline is likely to continue.

Only a few other trees are planted. The papaya is the leading fruit tree as we commonly use the term, but it does not thrive as well as on the volcanic islands and is not very important as a source of food in Mokil. A few lemon trees on Urak and a few soursop trees (*Anona muricata*) complete the list of the edible-fruit trees of Mokil. Although some 17 or 18 additional trees are utilized for one purpose or another, only two are reported as ever being planted by the natives. It is of interest that one of these is the *mes* tree, the leaves of which are so much in demand as fertilizer in *mwäng* and *jaua* culture.



FIG. 14. Shed covering pit in which pit breadfruit is stored.

Several non-tree crops are of some importance in the coconut lands. The banana is outstanding in this group. The natives say that fourteen varieties of bananas are raised in Mokil, seven "cooking" and seven that are eaten raw. In spite of this imposing number of varieties, however, bananas do not thrive as well as they do in the neighboring "high" island groups, Ponape and Kusaie. Nevertheless, the fruit forms a valuable addition to the diet of the atoll. Boiled bananas are a common dish, and bananas are used in a number of food combinations. The natives report, moreover, that the banana is their premier medicinal plant.

Throughout Mokil, bananas are planted in sites where the soil is richer and moister than the average for the atoll (Fig. 3). A few invade the edges of the large wet garden on Kalap, and they are common on two islands of higher ground in this depression. They are important on the land that surrounds this wet garden, especially to the southwest and south where a belt of higher and somewhat richer

than average ground has resulted from past excavations. Bananas also attain importance as a crop in central Urak and to a lesser degree in northern Manton, in much the same areas as those in which the *mwäng* pits occur.

Arrowroot (*Tacca Leontopetaloides*), known as *mokamok* to the natives, is scattered through the forest on all three islands, but is especially abundant in southern Manton (Fig. 3.). Much appears to be growing wild, but some is planted. A starch made from the tubers is a food by itself and is used in various food mixtures.

Livestock, confined to the coconut lands, play only a minor role in the economy of Mokil. Since there is neither the space nor the feed for cattle, pigs and chickens are the only types represented. The pigs are kept in crude pens and are diminishing in numbers because the people prefer to use the chief swine feed, coconuts, for copra making. Chickens are fairly numerous, every family owning a few. They are kept almost entirely for their meat since eggs are not highly regarded as a food by the island peoples of the Pacific. Since the chickens wander and nest at will it is not surprising that both chickens and eggs are small.

#### THE FISHING INDUSTRY

The people of Mokil, like other atoll dwellers, place much dependence upon fish. Women take little part in fishing, but every man is a fisherman<sup>9</sup> and fish appear to compensate for the lack of livestock.

Often the importance of the lagoon to atoll people has been exaggerated. In Mokil, at least, the lagoon is of little significance as a source of food. Though the people depend much upon sea resources, they obtain nearly all of these on and outside the reef.

Fishing methods have changed with availability of equipment. Hooks and lines (either with bait or with artificial lures), nets, and spears are used depending upon the particular objective. There are still a few shell fishhooks to be seen, but they are used only when outside supplies are cut off. Similarly, the occasional use of fish lines made from the inner bark of an atoll tree reflects a shortage of store supplies. In the summer of 1947 the people listed steel fishhooks and all kinds of fish lines and wire leaders as being badly needed.

Bonito is the most prized fish. It is caught by line outside the reef with bait or with artificial lures. Although the bonito is caught all year it is considered useless to try for these fish except at dawn, and then only on those mornings when there is sufficient wind so that the sailing canoe moves briskly. Nearly as important as bonito, and caught in much the same manner, is *lajapule* or ocean bonito. Several other fish are important. Lobsters are obtained on the reef, and turtles are caught in the lagoon.

#### BOATBUILDING AND CARPENTRY

Boatbuilding is an essential part of the economy of Mokil. Whaleboats and canoes are needed for daily travel back and forth to the other islands; canoes, and to

<sup>9</sup> There is little specialization in Mokil. Thus every man is a farmer, a fisherman, and a boatbuilder.

a lesser extent whaleboats, make fishing possible; and whaleboats furnish the contact between the station ship and the islands. It might be thought that these needs would prevail on every island group in the Pacific and that they would all have boatbuilding industries. But the matter has gone much farther in Mokil, and the atoll is pre-eminent for its manufacture of whaleboats and sailing canoes.

In the summer of 1947 twenty-two sailing canoes and two whaleboats were under construction in Mokil. Breadfruit, coconut, and some 10 or 12 other kinds of wood are used in the industry, certain woods being considered especially suitable for specific portions of the boats. The making of a whaleboat, a task of much greater magnitude than canoe construction, is a group enterprise (Fig. 15). Approximately



FIG. 15. Natives building a whaleboat in Kalap Village. A whaleboat is approximately 21 feet in length and its construction is a group enterprise.

ten men work together in making these boats. No pay is involved, but each man keeps track of the time he spends working on another man's whaleboat. He has a right to expect an equivalent amount of labor in return when he builds one for himself.

The primary purpose of the boatbuilding industry is to furnish the canoes and whaleboats needed in Mokil, but there is a demand for Mokil-made whaleboats in Ponape and at times the craft are sailed to this larger island group and there find a ready market. Unfortunately, the resources of Mokil set a limit on the industry since wood suitable for boat construction is becoming increasingly scarce.

Not only are Mokil men known for their boats; they are famed as exceptionally fine carpenters in general. In the summer of 1947 their services were in demand on Ponape where the main buildings of the Military Government base were being relocated. Their wages were an added source of income for Mokil, but one that could hardly be expected to be permanent.

## NATIVE HANDICRAFTS

Native handicrafts have a place in Mokil's economy comparable to that of copra; they are a source of cash. But they are considerably less important in this respect than copra. The total value of handicraft products sold is probably considerably less than \$1000 per year as contrasted with \$5000 to \$6000 for copra.

The chief handicraft products of Mokil may be briefly listed, together with the predominant raw materials used in each case:

mats:	pandanus	
fans:	coconut, pandanus, turtle shell, and chicken feathers, the latter dyed with ordinary commercial dyes	
belts:	coconut and pandanus, some turtle shell for buckles	
handbags:	pandanus	
hats:	the best hats, coconut; second-grade hats, pandanus	
rings (inlaid)	} turtle shell	
shoe horns		
watch bands		
belt buckles		
pocket combs		
model canoes:	wood ( <i>sisen</i> and other atoll trees)	

The handicrafts involve much careful labor. Practically all of the textile-type items on the list, and they constitute the bulk of the products, are made by women who do the work in their homes. All work in wood and shell, on the other hand, is done by men. Thus, they make not only the model canoes, but also the various turtle shell specialties.

The future of the handicrafts business does not appear bright. In the summer of 1947 handicraft products were being purchased at fixed rates by agents of the United States Commercial Company (a federal agency) each time the station ship came to the atoll and were distributed through the company's stores at Guam and other centers in the Pacific. The feeling seemed to be, however, that with further contraction in numbers of American service personnel in the Pacific the handicrafts would decline. Most of the items made are of little real value and would not be worth shipping far to market.

## THE VILLAGE AND THE PEOPLE

Although the 450 people of Mokil get their living from all three islands they have their homes on Kalap, and on Kalap most families have their permanent living quarters in the area southwest of the ancient wet gardens. Reasons for this localization are not hard to find. As is so often true in atolls, the life of Mokil fronts on the lagoon. All three islands may be thought of as facing the lagoon, with its protected, easily-navigable water, and having their backs to the open sea. The most advantageous location on the lagoon front was naturally the place of easiest access to the great depression from which the people derived most of their food supply.

The cultural map of Kalap clearly brings out the importance of the village (Fig. 16). Here carefully built stone piers interspersed with short strips of beach

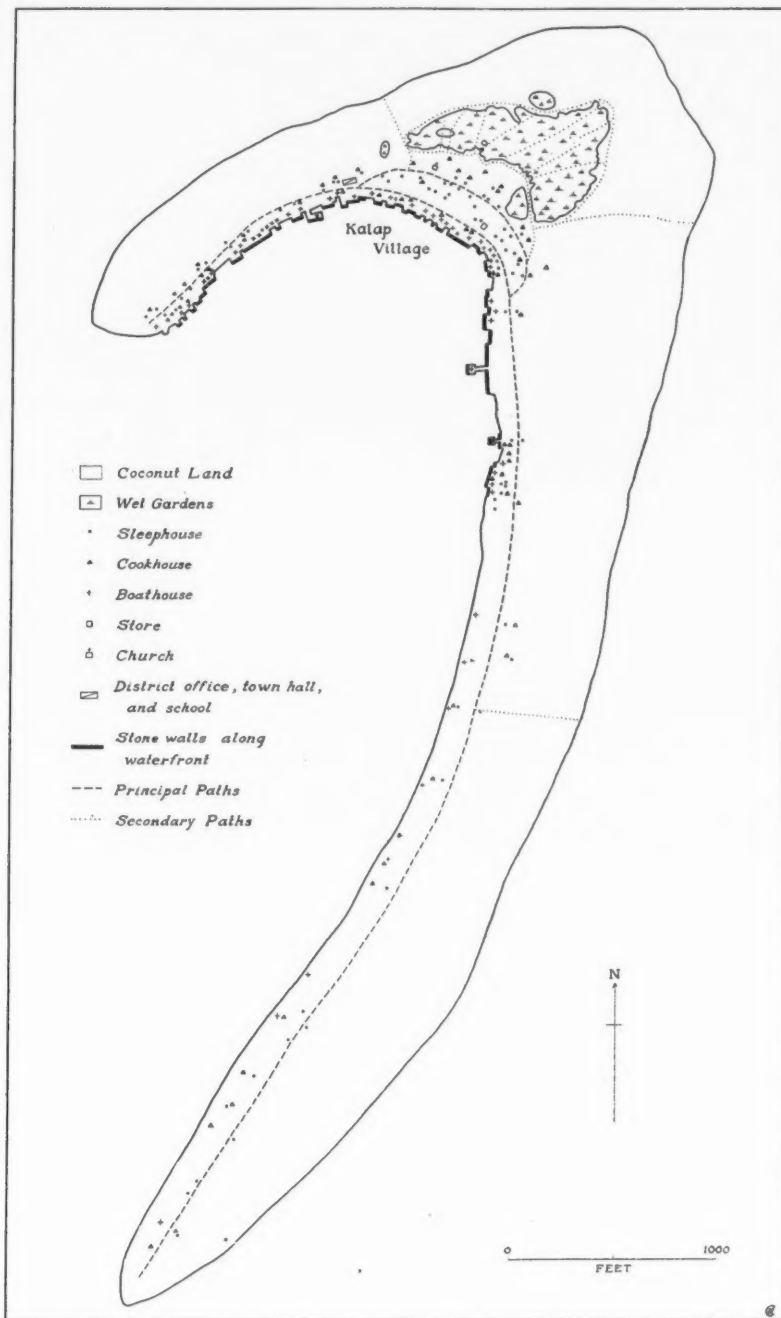


FIG. 16. Cultural map of Kalap motu.



FIG. 17. Rock piers alternate with beaches along the water front of Kalap Village. Although the original rock work was done in the German period the walls have been carefully maintained. Thatched boathouses and a typical cook-house may be seen in the picture.

form the water front (Fig. 17), boathouses occur in almost unbroken succession, and sleephouses and cookhouses are crowded into a limited area (Figs. 18 and 19). The district office, the town hall, and the school form a single, continuous building. Farther to the southeast along the principal street or path is the store. About half



FIG. 18. Some sleephouses are built of wood with galvanized iron roofs. The interior of such a house reaches such high temperatures that the owners sleep under rather than in the house.

way between the store and the school is the landing place where the whaleboats come and go that make contact with the station ship when it anchors off Manton. On a secondary path a little northeast of the main street are more sleephouses and cook-houses, and on this secondary path, too, is the church, an important element of the cultural picture. The village, since it houses most of the people, is the chief center of copra making. Here, too, most of the boats are made and the handicraft activities carried on. In short, Kalap Village is the heart of Mokil life.

#### CIRCULATION PATTERN

Kalap Village is the focus of paths that reach to various parts of the island of Kalap, and boats come and go between Kalap Village and the other islands of the atoll and between the village and the fishing grounds. By way of whaleboat and



FIG. 19. Many sleephouses are little more than thatched shelters.

station ship, connection is made between Kalap Village and Ponape and, through Ponape, with the outside world. This circulation pattern is an essential part of the atoll's economic geography.

Running the length of Kalap is a long road (or wide path) that was built by the natives in German times (Fig. 8). It is the customary route of travel from house to house and to and from the store, the school, the district office, and the main landing pier. All of the sleephouses of Kalap are arranged along this path or along the secondary path, almost as well developed, that runs parallel to the main street through the heart of Kalap Village. The church is the primary attraction on this branch path.

Naturally, the main path is used least at either end. Its use increases toward the center of Kalap Village, and there the secondary street shares the traffic. The

movement is the result of many influences and varies with the time of day. It reaches considerable magnitude each morning about six o'clock when a shell is used as a horn to call people to church. There is a similar movement to and from the church for the several services on Sunday and for prayer meeting on Wednesday afternoon. There is much activity, too, when the "horn" is used to call people to town meeting; and when the children go and come from school. But it reaches its greatest magnitude when word is received that a ship has been sighted off Manton. Then everyone heads for the center of the village to greet the people who have come in on the ship, to hear the news, to sell handicraft products to the agent of the trading company, and to be on hand when the village store, newly laden with merchandise, opens for business.



FIG. 20. Family leaving Kalap by whaleboat for a day's work on Urak.

The main path and its auxiliary are used, also, for all sorts of traffic concerned with the daily life of the community—movement of recently dug *mwäng*, of pandanus for thatching a roof, of ripe coconuts for copra making, of drinking coconuts for home use, of wood for building a house or whaleboat, and of a wide variety of other items.

The secondary narrower path on which the church is situated is important for another reason. From it lead smaller connecting paths to still another path that completely encircles the large wet garden (Fig. 16). A number of minor paths, in turn, cut across the garden (Fig. 5). These are especially important since all families must have access to their rows of *mwäng* and *jaua* that extend at right angles from the paths. The significance of these paths across the ancient depression may be illustrated by the longest one of the group. Through following it, access is gained to 52 different, separately owned groups of rows of *mwäng* and *jaua*. Both men and women following the system of paths may be seen going to work, with bundles of leaves and grass for fertilizer; or they may be seen returning later, very

dirty after their efforts, and possibly carrying newly-dug *mwäng* or *jaua* or some sugar cane stalks.

Paths reaching from the main paths of Kalap to the outer shore of the island, though less clearly marked, are also important. On the reef off the outer shore the people gather minor items of fish food and shells, or they may use spears or nets to obtain fish. And all of these paths and other less distinct ones are used to bring in coconuts, breadfruit, pandanus fruit or leaves, *mes* leaves, and other products of the land to the various homes in the village.

Though Kalap is the principal island, Urak is almost as important and Manton is far from being negligible in the economy of Mokil. The connection with Urak is represented by the movement of whaleboats and canoes (Figs. 2 and 20). Generally, they go out in the morning taking a family to work. After disembarking, these people go by various minor trails, none of which is very well defined, to their Urak holdings. In the late afternoon the boats come back from Urak laden with coconuts, coconut husks, *mes* leaves, bundles of grass, pandanus, breadfruit, and other products. Generally, the boats returning to Kalap follow a standard course across the reef from the north shore of Urak and then across the lagoon, but, occasionally, where holdings are near the southern edge of Urak, boatloads of coconuts may be brought back at high tide from the south shore.

In similar fashion there is movement back and forth between Kalap and Manton, but to a lesser degree than between Kalap and Urak since Manton is smaller and fewer families have holdings there. This movement is easier since the normal course is across the lagoon without traversing any reef. But from Manton, too, loads of coconuts may occasionally be brought back to Kalap Village at high tide from the west or reef shore. Important in the Manton movement is the taking of bags of copra from Kalap Village to the storage sheds on the west shore of Manton, there to await the arrival of the station ship. Generally, the bags of copra are unloaded on the lagoon shore and carried by a well-defined path that leads to the copra storage sheds on the west coast, but occasionally the copra is taken directly to the copra sheds by boat at high tide.

Another important element of the circulation pattern is that between Kalap Village and the fishing grounds. Bonito fishermen go out during the night in order to be outside the reef at three or four o'clock in the morning; ordinarily they are back at Kalap Village by six or seven o'clock just as the village is stirring into life. For *redfish*, the fishermen go in the evening; and there are other similar movements synchronized with the type and habits of the various fish.

The station ship which arrives on an average of once a month represents still another element of Mokil's circulation pattern. The ship anchors west of the reef off Manton (Fig. 2). Then there is the movement of whaleboats to and from Kalap Village with people and merchandise. In going and coming from the lagoon these boats must use a poorly-defined channel across the reef south of Manton. Whaleboats are used, also, to take the copra from the storage sheds on the west coast of Manton to the ship.

The station ship that visits Mokil continues to Pingelap and Kusaie and then returns over the same route to Ponape (Fig. 1). But it is the arrival from Ponape and the departure for this large island group to the west that are of most significance to Mokil. There is, for example, a movement of people back and forth from Ponape. Some have land in Ponape to look after; others go to the large island group for temporary employment as carpenters at the government base. Young people from Mokil go to Ponape for training as teachers or as local policemen, or they may even be sent to the hospital at Guam from which they will return several years later as native nurses or doctors.<sup>10</sup>

Ponape is, moreover, the gateway through which economic goods come and go between Mokil and the outside world. The copra sent out by station ship reaches United States vegetable oil users; and handicraft products passing through Ponape are sold, largely to Navy personnel, and thus eventually reach many homes in the United States. In reverse, merchandise from the United States passes through Ponape for sale in the store in Mokil.

It is through Ponape, too, that the wishes of the United States Government reach the atoll. And the complaints or troubles of the people of Mokil are brought to the Ponape base and may eventually reach Washington.

#### MOKIL AND THE FUTURE

Mokil's greatest problem is overcrowding, a condition that is particularly serious in view of the rigid limitations of the atoll environment. In volcanic island groups, such as Ponape and Kusaie, there is always the possibility of new crops that will provide additional exports or will at least make a substantial contribution to the welfare of the people. In Mokil as in other atolls this possibility is practically nonexistent. No significant additions have been made to the agricultural picture for many years. And production of the one commercial crop, coconuts, has already been expanded to the utmost.

If the present rate of population growth continues then there are only two possible solutions. One is to dig more wet gardens. This would allow more people to live on a subsistence basis, but it would mean retrogression and would not be a popular solution. There has been no tendency in this direction. The second solution is emigration. Already a number of Mokil natives are living in Ponape and there is room for more. They may prefer the atoll environment, but in Ponape land is available and also opportunities for obtaining work at the government base.

There is another matter that must be of concern to any governed people, the matter of treatment by the governing nation. The oldest citizens of Mokil have

<sup>10</sup> During the writer's seven weeks in Mokil no doctor was available. There *was* a native medical practitioner left over from Japanese times, but he had been trained under the Japanese and knew no English and the labels on his bottles were in English. His abilities were not highly regarded even by the natives. Fortunately, however, health conditions in Mokil are excellent—much better than in the average island group of Micronesia. There is no malaria, but the field worker must look out for intestinal parasites and skin infections.

seen the Spaniards come and go, the Germans come and go, and then the Japanese. The American flag now flies over Kalap Village. What has this meant to the people and what will it mean? It is too early to tell. In the summer of 1947 the people were still profoundly impressed by the fact that they had become wards of what they considered the greatest of all nations. They are likely to judge their new rulers chiefly on an economic basis. Are they, the people of Mokil, more or less prosperous than they were under the Japanese? The answer is that there probably is little difference. The natives of Mokil as well as of other island groups of American Micronesia are paid more for their copra and handicraft products, but they pay more for the supplies they buy from the store.

Since the income of the atoll means little except in terms of what it will buy, the real test in the long run will be how well off the people are in things they consider essential. In the summer of 1947 the supplies brought to Mokil by the United States Commercial Company left much to be desired. Many items needed for everyday use were not arriving at all. This may have been partly due to the depleted economy of the United States, since even on the mainland many items of merchandise were still hard to get. Or, such lacks may be inherent in the distant location of the atoll. Supplies travel a long distance to get to Ponape and then must be reshipped to Mokil, Pingelap, and Kusaie. But if the natives are to be happy under United States rule then it is the supply of these "essential" items that must be looked to and not merely money paid to the natives. A well filled pocketbook may mean little in terms of fulfillment of daily needs in Mokil.